DSGD DISCUSSION PAPER NO. 13

BLUNT TO SHARPENED RAZOR: INCREMENTAL REFORM AND DISTORTIONS IN THE PRODUCT AND CAPITAL MARKETS IN CHINA

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ACKNOWLEDGEMENTS

Extensive data support from the national income department of China State Statistical Bureau is gratefully acknowledged. The authors appreciate the helpful comments from Chong-En Bai, Gregory C. Chow, Shenggen Fan, Angang Hu, Peter Hazell and participants in the Workshop on National Market Integration organized by the World Bank Beijing Office and the Development Research Center of the China State Council, September 6, 2003, Beijing, China.

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ABSTRACT

A key objective of China's reform program was to reduce distortions in the economic system and enhance growth. However, when implemented in incremental and partial ways, local governments or individuals have chance to capture rents inherent in the reform process. Young (2000) warned that the rent-seeking behavior might lead to increasing market fragmentation. Empirical studies have since shown that this did not happen in the product markets. In this paper we argue that as rents from the product markets were squeezed out during the reform process, rent-seeking behavior shifted to the factor markets, especially the capital and land markets. The reform process now needs to be deepened to ensure that the factor markets also become more integrated and efficient.

JEL Keywords: Reform, China, Rent Seeking, Factor and Product Market, Transition.
JEL Classification Code: D33, D61, D63, O11, O53, P23.

BLUNT TO SHARPENED RAZOR: INCREMENTAL REFORM AND DISTORTIONS IN THE PRODUCT AND CAPITAL MARKETS IN CHINA

Xiaobo Zhang and Kong-Yam Tan [*]

I. INTRODUCTION

Over the past 25 years, China's transformation from a centrally planned to an increasingly market driven economy has led to substantial efficiency gains and rapid economic growth (Maddison, 1998; Fan, Zhang and Robinson, 2003). However, as Young (2000) has argued, the reforms may not have been sufficiently complete to improve domestic market integration. This could happen, for example, if increased inter-regional competition due to fiscal decentralization led local governments to impose a variety of trade protection measures against each other. Young's work has stimulated a series of studies to investigate trends in market integration. A recent survey by the Development Research Center of the China State Council (2003) indicates that China's domestic product markets have actually become more rather than less integrated. Measures of regional protection have also declined significantly over the past decade. Wei and Fan (2004) show that output prices have become more integrated, and Huang et al. (2003) use evidence from the rice market to argue that China's commodity markets are becoming increasingly integrated as a result of the reforms. Based on a panel data set of 32 two-digit industries in 29 provinces, Bai et al. (2004) show that after an initial decline, there was an increase in regional specialization of industrial production.

These findings would appear to contradict Young's predictions about worsening market fragmentation. However, we argue that such a contradiction need not arise if Young's work is considered in a broader political economy framework. As argued by

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Piñera (1994) and popularized by Rodrik (1996), reforms often follow a J-curve. That is, reforms may initially bring about more distortions but after the negative effects reach a certain threshold, the political imperative for in-depth reforms will emerge, creating positive effects in the long run (Krueger, 1993). In China's case, after a serious trade war between regions in the 1980s and the early 1990s, the National People's Congress passed the "Law on Unjust Competition" in 1993. The State Council issued an order No. 303 "Stipulation of the State Council to Forbid Regional Blockade in Market Activities" in 2001. These more radical measures seem to support the argument by Drazen and Vittorio (1993) that crises may be a catalyst for reforms. These laws and regulations may have helped remove measures of local protection in product markets and led to a reversal of the initial trend towards more market segregation.

It is also possible that market distortions shift from product to factor markets as the reform process proceeds. de Brauw et al. (2002) show that there has been a huge transfer of rural labor from the low-productivity farming sector to high-productivity nonfarm sectors over the past two decades, suggesting a shift towards a more integrated rural labor market. But this shift, particularly if accompanied by similar improvements in other factor markets, should be leading to some convergence in income levels among China's regional economies. This would follow in theory if the marginal returns to factors were equalized across sectors and regions. In reality, however, China's regional inequality has increased rapidly (Kanbur and Zhang 1999; Gustafsson and Li, 2002), suggesting possible greater fragmentation in some markets. If the product and labor markets are becoming more integrated as evidenced by the studies mentioned above, then could it be that capital markets are becoming more fragmented? The dramatic increase in the number of reports on corruption within the banking and real estate sectors suggests that rent seeking behavior may indeed have shifted to the financial sector as the reform of product and labor markets deepened.[1] We address this question in this paper.

[1] Some of the recent reports on rent seeking activities in the banking and real estate sectors include Yang Xiuzhu, vice chief of the construction department of Zhejiang Province who extracted bribes from property developers and disappeared (Caijing, July 23, 2003); Chen Kai, a local government official of Fuzhou, Fujian Province, who borrowed an estimated $50 million from six state banks and provided kickbacks of

To assess the degree of factor market fragmentation, we divide the economy into four sectors: urban industry, urban services, agriculture, and rural enterprises.[2] Our analysis is based on estimating production functions for each sector, using provincial time series data for 1978-2001. One side contribution of our analysis is the computation of a capital stock series by sector, using fixed investment data from the State Statistical Bureau that are not yet fully publicly available. We use our estimated parameters from the regression equations to quantify the regional variation in the marginal products of capital and labor by sector. The results confirm that labor markets are becoming more integrated, but also show that capital markets have become more fragmented. As the reforms in the product markets have deepened, the former distortions do seem to have shifted to the capital market. In this sense, Young's argument is still valid: in a partially reformed economy, distortions may beget more distortions. However, the distortions may not necessarily arise in the same sector.

The paper is organized as follows. We first present data on changes in labor and capital productivity across sectors and regions in the Chinese economy over recent decades. Next, we calculate the Hoover coefficient of localization to examine the trend in product market integration. In the fourth section, we quantify regional variations in the marginal products of capital and labor, which serve as good indicators of factor market integration. We then simulate the efficiency gains for economic growth if the current

around 5 percent of the loans to the lending officers (Washington Post, December 17, 2003), Shanghai real estate tycoon; Zhou Zhengyi, who was implicated in an array of illegal loans coupled with default on statutory compensations for relocatees whose homes were improperly demolished for redevelopment projects (Shanghai Daily, September 6, 2003); former chairman of China Everbright Group, Zhu Xiaohua who was sentenced to jail for 15 years in November 2002 for taking bribes worth 4 million yuan (Caijing, December 25, 2003); Zhu Yaoming, a stock speculator who was arrested in July 2003 for loan fraud involving 2 billion yuan which he borrowed from securities firms and banks to speculate on stocks in the Shanghai and Shenzhen stock exchanges (Caijing, December 25, 2003). Numerous Communist Party officials have also been ousted for accepting bribes involving property and real estate projects. They included former CCP general secretary of Guizhou province, Liu Fangren; former CCP general secretary of Hebei province, Cheng Weigao; former Minister of Land and Resources, Tian Fengshan, as well as a former vice mayor of Shenzhen Cty and the former mayor and a vice mayor of Shenyang City.

[2] The rural enterprise sector includes all non-farm activities such as rural industry, construction, transportation, and commerce.

barriers to factor flows across regions and sectors are removed. The paper concludes with our conclusions. The appendix provides additional details about our data.

II. CHANGES IN FACTOR PRODUCTIVITY

Driven largely by institutional reforms, the Chinese economy has experienced a dramatic transformation over recent decades.[3] The share of agricultural Gross Domestic Product (GDP) in total GDP declined from more than half in 1952 to less than 20 percent in 2001, while the share of the rural nonfarm sector increased from almost zero to more than a quarter. Coupled with these structural changes was a massive shift of labor from the lower productivity agricultural sector to the higher productivity nonfarm sector. However, some factor markets are still fragmented and government policies still retain a significant urban bias. For example, the government still invests more in urban than in rural areas; universities require higher admission scores for rural than urban students; there are still formal and informal restrictions on migration from rural to urban areas; and it is much harder for rural small businesses to obtain credit than the urban based, state-owned enterprises. The recent arrest and release of millionaire entrepreneur Sun Dawu for illegally accepting deposits from local residents highlights the difficulties of many rural nonfarm enterprises in raising funds from state-owned banks and credit co-operatives (Economist, 2004).

The data in Tables 1 and 2 on labor and capital productivities by region and sector, respectively, highlight the dramatic changes in factor markets and economic structure over the period 1978 to 2001.[4] Labor and capital productivities are calculated as the ratios of GDP to labor and capital; they are therefore measures of average not marginal productivity. There are large regional variations in labor productivity and which have widened over time. The northeast region had the highest labor productivity in 1978, but by 2001 it had fallen well behind the eastern region. The regional gap between the

[3] Lin (1992) provides a good reference for rural reforms; Theodore et al. (1994) cover the reforms of state owned enterprises; Lau, Qian, and Roland (2000) explain the rationale behind the successful price reform.

[4] The division of the four regions are as follows: (1): Heilongjiang, Liaoning, and Jilin provinces; (2) East: Municipalities of Beijing, Tianjin, and Shanghai; Hebei, Shangdong, Jiangsu, Zhejiang, Hainan, Fujian, and Guangdong provinces; (3) Central: Shanxi, Henan, Jiangxi, Hunan, Hubei, Anhui; and (4) West: autonomous regions of Nei Mongol, Ningxia, Xinjiang, and Tibet, Sichuan, Shanxi, Gansu, Ningxia, Qinghai, Yunnan, Guangxi, and Guizhou provinces.

Table 1. Labor and Capital Productivity by Region, China, 1978 to 2001

	Labor Productivity					Capital Productivity				
Year	**China**	**East**	**Central**	**Western**	**Northeast**	**China**	**East**	**Central**	**Western**	**Northeast**
1978	868	1,073	707	619	1,672	36	41	38	25	45
1979	921	1,148	762	656	1,682	37	42	39	26	44
1980	974	1,250	792	684	1,714	38	43	39	27	45
1981	989	1,303	811	668	1,682	38	43	39	26	44
1982	1,046	1,375	865	714	1,718	38	43	40	28	43
1983	1,123	1,469	930	766	1,861	40	44	41	29	45
1984	1,260	1,655	1,046	853	2,072	42	45	43	32	47
1985	1,404	1,860	1,170	951	2,214	43	46	44	34	47
1986	1,472	1,966	1,221	989	2,316	42	44	43	34	46
1987	1,600	2,157	1,303	1,062	2,598	42	44	44	35	47
1988	1,751	2,411	1,403	1,151	2,822	43	45	44	37	47
1989	1,794	2,476	1,442	1,167	2,919	42	43	44	36	46
1990	1,841	2,578	1,471	1,201	2,912	41	42	42	36	43
1991	1,966	2,822	1,543	1,268	3,032	42	44	43	37	43
1992	2,262	3,359	1,762	1,406	3,331	45	48	46	40	44
1993	2,641	4,045	2,023	1,605	3,723	49	52	50	43	47
1994	2,993	4,658	2,292	1,769	4,116	52	55	53	45	48
1995	3,356	5,429	2,567	1,842	4,409	53	56	55	43	51
1996	3,709	5,980	2,837	2,099	4,719	54	56	56	46	54
1997	4,052	6,527	3,135	2,282	5,058	54	55	57	47	55
1998	4,563	7,337	3,359	2,853	5,663	54	54	55	54	55
1999	4,915	7,881	3,622	3,047	6,167	54	53	54	53	55
2000	5,190	8,539	3,882	2,848	6,768	52	52	54	47	57
2001	5,617	9,036	4,256	3,087	7,294	52	52	54	47	57
Growth rate (%)	**8.5**	**9.7**	**8.1**	**7.2**	**6.6**	**1.6**	**1.0**	**1.5**	**2.7**	**1.1**

Note: The unit of labor productivity is 1978 constant Yuan; the unit of capital productivity is 1978 constant Yuan per 100 Yuan capital stock. The figures are calculated by authors based on the data of 28 provinces, which are slightly different from those based on national data.

Table 2. Labor and Capital Productivity by Sector, China, 1978 to 2001.

Year	Labor Productivity					Capital Productivity				
	China	Agriculture	Urban industry	Urban service	Rural nonfarm	China	Agriculture	Urban industry	Urban service	Rural nonfarm
1978	868	346	3,245	1,949	623	36	52	46	19	22
979	921	367	3,256	1,943	807	37	55	45	20	23
1980	974	369	3,386	2,027	902	38	55	47	21	23
1981	989	385	3,240	2,104	972	38	58	44	23	24
1982	1,046	424	3,268	2,303	909	38	64	43	24	24
1983	1,123	453	3,495	2,503	907	40	68	43	25	26
1984	1,260	509	3,783	2,883	856	42	74	45	26	30
1985	1,404	533	4,601	3,221	778	43	73	46	27	38
1986	1,472	546	4,803	3,420	874	42	74	43	28	43
1987	1,600	566	5,086	3,790	1,021	42	76	43	29	47
1988	1,751	563	5,549	4,238	1,249	43	74	43	31	54
1989	1,794	559	5,649	4,432	1,397	42	75	41	30	56
1990	1,841	585	5,713	4,615	1,510	41	78	38	30	59
1991	1,966	580	6,102	5,016	1,691	42	78	39	31	62
1992	2,262	612	6,944	5,528	2,183	45	79	42	33	74
1993	2,641	661	7,582	6,190	3,012	49	80	44	34	94
1994	2,993	709	8,254	6,051	3,863	52	78	46	34	109
1995	3,356	761	8,636	6,313	4,867	53	74	45	33	120
1996	3,709	827	9,246	6,062	5,770	54	71	47	31	137
1997	4,052	856	10,755	6,329	6,072	54	67	49	30	140
1998	4,563	917	13,239	7,004	6,729	54	65	51	29	152
1999	4,915	943	15,089	6,920	7,666	54	62	49	27	170
2000	5,190	945	17,060	7,362	7,488	52	58	50	26	174
2001	5,617	988	18,613	7,798	7,944	52	57	52	25	187
Growth rate (%)	**8.5**	**4.7**	**7.9**	**6.2**	**11.7**	**1.6**	**0.4**	**0.5**	**1.2**	**9.7**

Note: The unit of labor productivity is 1978 constant Yuan; the unit of capital productivity is 1978 constant Yuan per 100 Yuan capital stock. The figures are calculated based on provincial data by authors.

west and the rest of China has also worsened over time. Compared to labor productivity, the regional disparities in capital productivity are much smaller and they have narrowed over time.

Table 2 shows that labor productivity grew the fastest in the rural nonfarm sector and slowest in the agricultural sector. Labor productivity began at a relatively low level in agriculture and the gap with other sectors is now much wider. The transfer of rural labor from farm to nonfarm activities will undoubtedly have enhanced overall economic growth and labor productivity. Regarding capital productivity, the rural nonfarm sector has again experienced the most rapid growth and by 2001 had achieved the highest level of all sectors. These disparities highlight capital market imperfections and the hunger for credit and capital that remains within rural areas for nonfarm activities. Broadening access to credit and investing more in the rural nonfarm sector would enhance economic efficiency and growth.

To put China's economic transformation in a broader international perspective, Table 3 compares the labor productivity of the industrial and service sectors relative to agriculture for China and several other Asian countries. The differences are stark. The labor productivity ratio of industry relative to agriculture is much higher in China than in other Asian countries. Moreover, while the ratios for other countries have generally remained stable or fallen, the ratio for China has risen substantially over the past 20 years. The same is true for the labor productivity ratio between the services and the agricultural sector. In the one hand, these extremely high ratios for China as well their increasing trends are symptomatic of major distortions in China's factor markets. On the other hand, there is clearly considerable potential for further economic growth simply by reallocating labor and capital among sectors.

Table 3. Trends in the Labor Productivity of Industry and the Service Sector as a Ratio of Agricultural Labor Productivity, China and Other Selected Asian Countries

Year	IN/AG	SE/AG	Year	IN/AG	SE/AG
China			Indonesia		
1978	7.0	4.9			
1988	4.6	3.8	1993	7.2	3.6
1995	5.4	3.2	1998	7.0	2.8
2001	7.5	4.0	2002	6.5	3.0
Philippines			Malaysia		
1989	4.4	2.1	1987	2.7	1.5
1995	4.5	2.1	1995	2.1	1.8
2002	4.2	1.8	2001	2.5	1.9
Korea			Taiwan		
1987	2.5	2.6	1988	2.6	3.9
1995	2.4	1.9	1995	2.9	4.7
2002	3.1	1.7	2002	3.0	4.5
Japan			US		
1990	3.2	3.0	1987	1.5	1.6
1995	3.1	3.4	1995	1.8	1.7
2001	3.3	3.4	2001	1.4	1.3

Note: AG: Agriculture; IN: Industry; SE: Services
Source: Word Development Indicators, World Bank.

III. TRENDS IN PRODUCT MARKET INTEGRATION

In this section, we update Young's analysis of the trends in market integration to a more recent time period. Following Bai *et al*. (2004), we use the Hoover coefficient of localization to measure the degree of regional specialization. This coefficient measures the geographic distribution of production activities within a sector. We define the Hoover coefficient of localization using our four-sector breakout of national GDP (farming, urban industry, urban services, and rural nonfarm) as:

$$L_{ij} = \frac{Y_{ij}}{Y_i} \Big/ \frac{Y_j}{Y} \qquad (1)$$

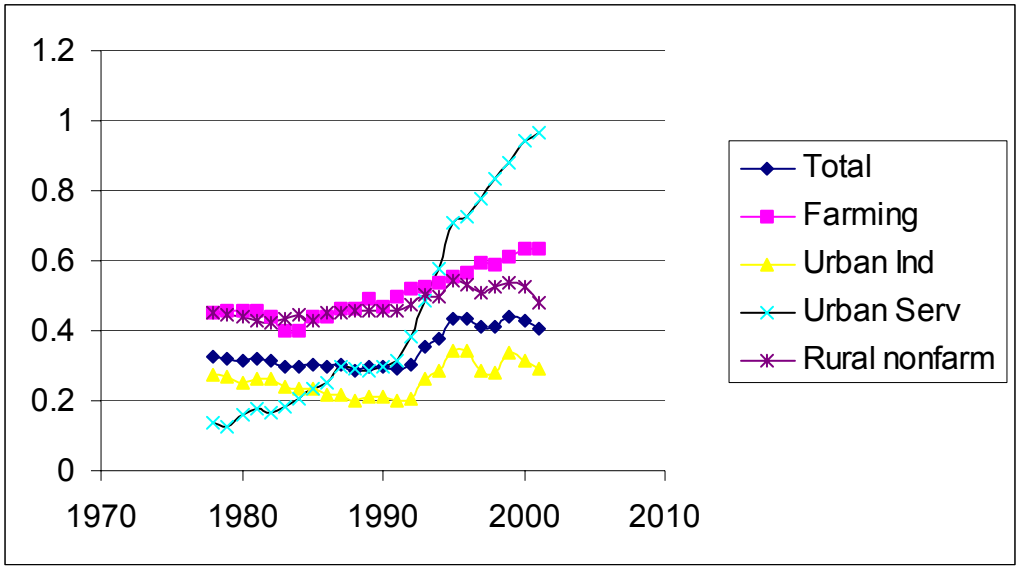
where Y_{ij} is GDP of sector i in province j; Y_i is national GDP in sector i; Y_j is national GDP in province j; and Y is national GDP. If L_{ij} equals one, then province j has the same share of sector i as China as a whole. We rank all the provinces by L_{ij} in descending order. Following the sequence, we calculate the location curve with the y-axis as the cumulative percentage of GDP in sector i over the provinces and the x-axis as the cumulative percentage of national GDP for all sectors over the provinces. Similar to the Lorenz Curve and Gini coefficient for income distribution, the Hoover coefficient of localization is defined as the ratio of the area between the 45-degree line and the location curve and the area of the entire triangle. Finally, we compute the average Hoover coefficients across the four sectors using GDP as a weight.

As shown in Table 4 and graphed in Figure 1, the Hoover coefficients for the farming, urban industrial, and rural nonfarm sectors declined in the 1980s, indicting decreasing regional specialization in the early period of reform. The result is consistent with Young's finding on the evolution of the primary, secondary, and tertiary sectors. However, the coefficients increased in the 1990s, leveling off in most cases at values that were considerable higher than observed in 1978. In other words, regional specialization did improve with the reform process, but took some years to materialize. The Hoover coefficient for urban services increased the most (from 0.14 to 0.97), showing that this sector has become the most specialized.

Table 4. Hoover Coefficients of Localization by Sector, China, 1978 to 2001

Year	Average	Farming	Urban Industry	Urban Service	Rural nonfarm
1978	0.32	0.45	0.27	0.14	0.45
1979	0.32	0.46	0.27	0.13	0.44
1980	0.31	0.46	0.25	0.16	0.44
1981	0.32	0.46	0.26	0.17	0.43
1982	0.32	0.44	0.26	0.17	0.42
1983	0.30	0.40	0.24	0.18	0.43
1984	0.30	0.40	0.23	0.20	0.45
1985	0.30	0.44	0.24	0.23	0.43
1986	0.30	0.44	0.22	0.25	0.45
1987	0.30	0.46	0.22	0.30	0.45
1988	0.29	0.46	0.20	0.29	0.46
1989	0.29	0.49	0.21	0.29	0.46
1990	0.30	0.47	0.21	0.30	0.46
1991	0.29	0.49	0.20	0.32	0.46
1992	0.31	0.52	0.21	0.39	0.47
1993	0.35	0.52	0.26	0.48	0.50
1994	0.38	0.54	0.29	0.58	0.50
1995	0.43	0.56	0.34	0.71	0.54
1996	0.44	0.56	0.34	0.72	0.53
1997	0.41	0.59	0.29	0.77	0.51
1998	0.41	0.59	0.28	0.84	0.53
1999	0.44	0.61	0.34	0.88	0.54
2000	0.43	0.63	0.31	0.95	0.52
2001	0.40	0.64	0.29	0.97	0.48

Figure 1. Hoover Coefficients of Localization



The average coefficient calculated across all sectors followed a J curve. An initial decline was followed by an upward trend that led by 2001 to a higher overall degree of regional specialization than in 1978. This confirms that there has been an overall improvement in product market integration. In general, the evolving pattern of regional specialization reported here for a four-sector disaggregation of GDP echoes the findings of Bai *et al*. (2004) based on a 36-industry breakdown. Our findings are also consistent with the literature on the political economy of reform as argued by Drazen and Vittorio (1993) and reviewed by Rodrik (1996) that crises often precede reforms and reforms often follow a J-curve. The initial product market reforms may have brought about more distortions in the short run, but after the government responds to the crises by deepening reforms, the rents in the product markets have been squeezed out over time.

IV. VARIATIONS IN MARGINAL RETURNS TO CAPITAL AND LABOR

Having shown recent trends in product market integration, we turn now to an analysis of possible disequilibria in the factor markets. From economic theory we know that resource allocation is most efficient when the marginal products of each input are equalized across sectors and regions. By calculating inter-sectoral and inter-regional variations in the marginal product of each factor, we can uncover the degree of factor market distortions and hence the opportunities for achieving greater economic efficiency through improved factor allocation.[5] To calculate the marginal productivities of each factor, we use regional and time series data to estimate production functions for each of our four sectors.

Given the sector-wide shift in China's economic structure in recent decades, we chose a functional form that allows the input elasticities to vary over time in the estimated production functions. Also, to avoid potential heteroscedasticity problems due to large regional differences, we add regional dummies to the production functions. We specify the following functional form for sector i:

$$\ln\left(Y_{ijt}\right) = A_{it} + \sum_k B_{ikt} \ln(\mathrm{X_{ijkt}}) + \sum_m C_{im} R_m + \varepsilon_{ijt}. \qquad (2)$$

Where $A_{it} = a_{i0} + a_{it}\, t + a_{itt}\, t^2$, and $B_{ikt} = b_{ik} + b_{ikt}\, t$. Y_{ijt} is GDP of sector i in province j and X_{ijkt} is the k^{th} input for sector i in province j. R_m is regional dummy for region m and C_{im} is the corresponding coefficient for sector i. Within each time period (fixed t) and each sector, the production function is of Cobb-Douglas form. Because the output and input factors may be influenced by the same factors, it is likely that endogeneity will be present. However, due to lack of viable exogenous instruments for cross-sectional regressions, the treatment of endogeneity problems is often less satisfactory (Durlauf, 2001). Since the main purpose of this study is to uncover the

[5] Desai and Martin (1983) have estimated the efficiency loss due to resource misallocation in the former Soviet industry using similar method.

correlations rather than the causality between the input and the output variables, the potential endogeneity problem may be less serious.

It is well known that education levels between cities and rural areas are substantially different. However, since we do not have a suitable education variable that can capture differences in the education status of the labor force in different sectors and regions, we could not control for labor quality in the regressions. As a rough test of the potential biases that might arise from this simplification, we used the fact that the most highly educated part of the labor force is concentrated in Beijing, Shanghai, and Tianjin, and re-estimated our production functions after dropping these cities from the analysis. The results did not change significantly, providing some assurance that the results are not sensitive to our inability to control for labor quality.

A detailed description of the data used is provided in the Appendix. We used data for 24 years (1978-2001) for 28 provinces, providing a panel of 672 observations. Tibet is excluded mainly because of lack of data. For data consistency, Hainan and Chongqing provinces are included in Guangdong and Sichuan provinces although they were separated in 1987 and 1997.

The results of the estimated production functions for the four sectors are presented in Table 5.[6] The estimated function for agriculture includes land as a separate input in addition to capital and labor. Because agricultural output is measured as value-added, intermediate inputs such as fertilizer are excluded from output measures by definition. Including fertilizer and other intermediate inputs is more appropriate in estimating a production function for gross output. The regression results for agriculture indicate that land still plays an important role in Chinese agricultural production and that even though the elasticity is diminishing over time it was still 0.332 even at the end of sample period. The strong, positive coefficients on the time-trend variables imply that technical change

[6] The calculations of variations in marginal products of factors are rather robust to various specifications in large because marginal products are mainly determined by factor productivity rather than by the estimated elasticities. For simplicity, the inequality measures based on several alternative specifications are not reported here but are available upon request.

played a vital role in driving Chinese agricultural production during the study period. The time-varying coefficients for capital and labor are positive and negative, respectively, suggesting that the agricultural sector has become more capital intensive and less labor intensive.

Table 5. Estimated Production Functions by Sector, China

	Agriculture		Urban industry		Urban service		Rural nonfarm	
Labor	0.714**	(0.064)	0.889**	(0.063)	0.578**	(0.055)	0.411**	(0.061)
Capital	0.016	(0.043)	0.262**	(0.064)	0.183**	(0.044)	0.294**	(0.069)
Land	0.293**	(0.062)						
Labor*t*10	-0.490**	(0.122)	-0.004	(0.123)	0.463**	(0.121)	0.358**	(0.124)
Capital*t*10	0.046	(0.080)	0.009	(0.115)	-0.056	(0.086)	0.043	(0.129)
Land*t*10	0.279**	(0.122)						
Labor*t^2*100	0.148**	(0.050)	-0.046	(0.052)	-0.262**	(0.054)	-0.122**	(0.051)
Capital*t^2*100	0.022	(0.033)	0.025	(0.045)	0.106**	(0.037)	0.033	(0.052)
Land*t^2*100	-0.114**	(0.050)						
Time trend	0.153**	(0.048)	0.016	(0.044)	-0.087**	(0.038)	-0.113**	(0.031)
Time trend^2*100	-0.287	(0.194)	0.242	(0.186)	0.449**	(0.167)	0.596**	(0.139)
Eastern	0.086**	(0.037)	0.363**	(0.038)	0.318**	(0.043)	-0.413**	(0.052)
Central	-0.201**	(0.031)	-0.128**	(0.038)	0.146**	(0.035)	-0.511**	(0.053)
Western	-0.489**	(0.034)	0.024	(0.044)	-0.009	(0.039)	-0.805**	(0.053)
Adjusted R^2	0.956		0.936		0.955		0.963	

*Note: Figures in parenthesis are standard errors. The symbols * and ** indicate 5% and 10% significant levels, respectively.*

The estimated labor and capital elasticities for urban industry do not change significantly over time. The urban service sector has become increasingly capital intensive, probably reflecting the heavy investment in urban real estate. The most striking phenomenon in the rural nonfarm sector is that labor elasticities have increased over time, indicating increasing returns to scale in the industry and greater alignment with rural China's comparative advantage.

Differences in estimated elasticities for the same input across sectors reflect differences in production technology, but on their own do not provide any indication of how efficiently resources are allocated. To obtain such insights it is necessary to calculate the marginal productivities of each factor. Given the estimated time-varying parameters, we can compute the marginal product of each factor using the following relationship:

$$M_{ijkt} = \frac{\partial Y_{ijt}}{\partial X_{ijkt}} = B_{ikt} \frac{Y_{ijt}}{X_{ijkt}}, \qquad (3)$$

where k denotes factor, i represents sector and j stands for province. B_{ikt} is from equation (2).

To quantify the degree of variation in the marginal products of inputs, we use a Generalized Entropy (GE) inequality measure. Following Shorrocks (1980), the variation in marginal product of factor k at time t can be written as:

$$\text{GE(c)} = \begin{cases} \sum_{i,j} w_{ij} \left\{ \left(\frac{M_{ijk}}{\mu} \right)^{c} - 1 \right\} & c \neq 0,1 \\ \sum_{i,j} w_{ij} \left(\frac{M_{ijk}}{\mu} \right) \log \left(\frac{M_{ijk}}{\mu} \right) & c = 1 \\ \sum_{i,j} w_{ij} \log \left(\frac{\mu}{M_{ijk}} \right) & c = 0 \end{cases} \qquad (4)$$

where M_{ijk} denotes the marginal product of factor k for sector i in province j, μ is the sample mean, w_{ij} is the share of GDP of sector i for province j in total GDP. GE(0) is the mean logarithmic deviation, GE(1) is the Theil index, and GE(2) equals half the square of the coefficient of variation. We use the simplest form of this equation in which c = 0. The results for c=1 and 2 are similar to the results when c=0. Because each province has four sectors, we have 2,688 observations in total.

Table 6 reports the variations in marginal products of labor and capital. The marginal product of labor has shown some convergence over the reform period, except in the last five years of our analysis (but which may be the result of some changes in the way the labor surveys were conducted during those years—see appendix). The overall variation in the marginal product of labor initially declined from 0.45 in 1978 to 0.29 in

Table 6. Variation in the Marginal Products of Labor and Capital, China, 1978 to 2001

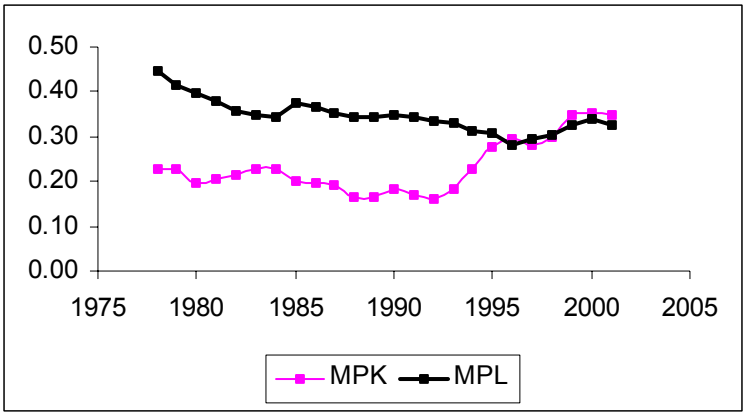
Year	MPL			MPK		
	Variation	Sector Polarization (%)	Regional Polarization (%)	Variation	Sector Polarization (%)	Regional Polarization (%)
1978	0.45	84.3	12.0	0.23	29.4	8.6
1979	0.41	84.5	11.5	0.23	32.0	10.0
1980	0.40	85.1	12.9	0.20	32.0	9.5
1981	0.38	83.5	14.3	0.21	34.1	13.2
1982	0.36	84.0	12.6	0.21	37.8	15.3
1983	0.35	83.6	12.0	0.23	40.2	14.0
1984	0.34	83.2	11.9	0.23	41.4	14.9
1985	0.38	83.7	14.7	0.20	42.8	16.3
1986	0.36	84.1	13.7	0.20	43.9	16.6
1987	0.35	83.9	14.4	0.19	45.5	16.3
1988	0.34	83.1	14.1	0.16	46.4	12.8
1989	0.34	82.8	14.7	0.17	47.8	15.1
1990	0.35	79.9	14.5	0.18	56.3	13.9
1991	0.34	79.8	14.3	0.17	53.7	12.4
1992	0.34	77.1	16.0	0.16	51.9	12.5
1993	0.33	70.3	18.1	0.18	51.0	9.5
1994	0.31	66.7	19.7	0.23	49.5	12.8
1995	0.31	62.1	23.3	0.28	56.1	17.5
1996	0.29	63.1	23.0	0.29	66.6	19.9
1997	0.30	60.6	22.2	0.28	70.4	15.1
1998	0.32	61.8	19.2	0.30	71.4	10.7
1999	0.35	66.3	15.6	0.35	74.5	8.3
2000	0.37	65.8	17.5	0.35	76.0	7.4
2001	0.37	67.4	16.2	0.35	80.0	3.2

1996 and then increased to 0.37 in 2001.[7] On the other hand, the variation in the marginal product of capital declined from 0.23 in 1978 to 0.16 in 1991 but then rose substantially to reach 0.35 by 2001. As graphed in Figure 2, the marginal product of capital become increasingly divergent during the 1990s, suggesting greater fragmentation of capital markets. This finding is consistent with Boyreau-Debray and Wei (2003) although they

[7] If excluding Beijing, Shanghai, and Tianjin in the sample, the variation in MPL declines from 0.41 to 0.30 from 1978 to 2001, while the variation in MPK increases by 81% from 0.23 to 0.35. In other words, dropping the three cities with the highest educational level does not affect the basic results from the whole sample.

use alternative approaches and data.[8] The results suggest that, faced with growing competition in product and labor markets, local governments may have tried to collect more rent in urban sectors such as real estate and infrastructure projects. In this sense, our findings support Young's argument that partial reforms may lead to more distortions in the remaining economy.

Figure 2. Variations in Marginal Product of Labor and Capital



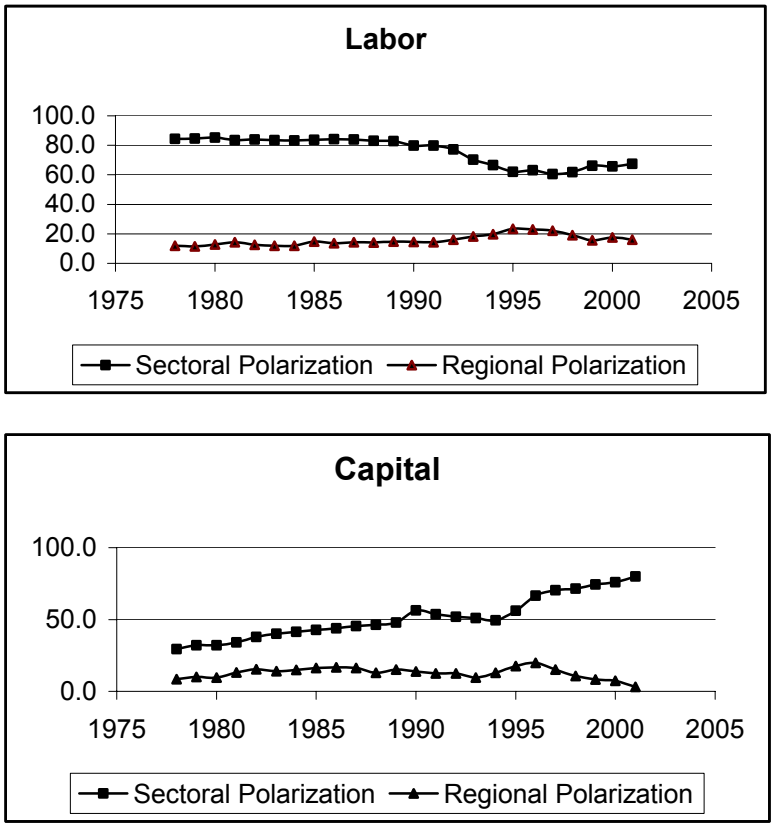
As is well known, the GE family of inequality measures can be decomposed into the sum of within and between group components for any given partitioning of the population into mutually exclusive and exhaustive groups. Using the ratio of between-inequality to overall inequality, we can calculate the polarization index following the method outlined by Zhang and Kanbur (2001).[9] Table 6 and Figure 3 present the sectoral and regional polarization indices for the marginal products of capital and labor. As more inter-sectoral variations in the marginal products of labor and capital contribute far more to overall inequality than inter-regional variation. In particular, the sectoral polarization

[8] They use two methods to test the degree of capital market fragmentation based on provincial data from 1978 to 2000. The first approach is to examine the correlation of local savings and investment. Under an integrated capital market, the correlation should be low. The second approach, drawing from the risk sharing literature, is to check the degree of consumption smoothing across time and space, which is an important indicator for measuring capital mobility and asset market completeness.

[9] A polarization index is defined as the ratio of between-inequality to overall inequality.

index on the marginal product of capital has increased. This provides further evidence that as the reform process has deepened in the product market, rent seeking distortions may have shifted to the capital market.

Figure 3. Polarization Measures by Sector and Region



These results indicate that there is room to improve China's overall economic efficiency simply by reallocating factors among sectors and regions. Our results suggest that reversing the entrenched urban-biased investment policies and undertaking in-depth reforms within the financial sector might not only improve economic efficiency the most but also promote greater equity as the lion's share of the poor live and work in rural areas.

V. POLICY SIMULATIONS

How large are the potential gains from improving factor market performance? To answer this question, we use the estimated production functions in Table 5 to calculate the potential increases in national GDP obtainable from simulated factor reallocations. Considering the low labor productivity in the agricultural sector, our first experiment is to move additional labor out of the agricultural sector. Using 2001 as a baseline, we evaluate three scenarios: moving 1%, 5%, and 10% of the agricultural labor force out of agriculture and distributing it equally among the other three sectors. As shown in Table 7, even reallocating just one percent of the agricultural labor force could increase national GDP by 0.7%. If the share of labor reallocated is 5% and 10%, then national GDP would increase by 3.3% and 6.4%, respectively.

Table 7. Impact of Alternative Policy Simulations on China's GDP

Simulation 1:			
Move x% of the agricultural labor force out of agriculture into other rural sectors	1%	5%	10%
Change in national GDP over 2001 (%)	0.7	3.3	6.4
Simulation 2:			
Reallocate x% of investment from cities to rural areas	1%	5%	10%
Change in national GDP over 2001 (%)	0.7	3.2	5.9
Simulation 3:			
Add x billion Yuan of investment in rural areas	10	50	100
Change in national GDP over 2001 (%)	0.2	0.8	1.7
Change in national GDP over 2001 (Billion Yuan)	21.4	85.4	181.5

In the second experiment, we simulate a change in the current urban biased policies by shifting investment from cities to rural areas while keeping total investment constant.[10] Reallocating 1%, 5%, and 10% of urban investment, respectively, to rural areas leads to gains in national GDP of 0.7%, 3.2%, and 5.9%, respectively. These are

[10] We recalculate the capital stock according to equation (1) in the appendix using the new investment data.

very similar in magnitude to the results obtained above by reallocating labor from agriculture to other sectors.

In the third experiment, we assume the government makes additional investment in rural areas, and that these are equally distributed between the agricultural and rural nonfarm sectors. Additional 10 billion Yuan of investment in rural areas yields an increase in national GDP of 0.2%, equivalent to 21 billion Yuan. This gives a very favorable benefit/cost ratio of 2.1. Considering that the farm and rural nonfarm sectors are labor intensive, this scenario would likely also help raise the incomes of many of the poorest people in China. When the size of investment increases to 50 and 100 billion, national GDP increases by 0.8% and 1.7%, respectively, with benefit/cost ratios of 1.7 and 1.82.

The policy simulation highlights the potential economic gains from reallocating factors from low to high productivity sectors. Removing barriers to labor movement, reversing the urban bias in government investment policies, and deepening the reforms would significantly enhance overall economic growth. In addition, these policy changes could also bring about favorable distributional effects by reducing regional and sectoral inequalities. Since large inequalities are a potential source of social conflict and instability, the far-reaching social impact of these policies could be equally important.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

A key objective of China's reforms has been to reduce economic distortions and improve market efficiency. This paper examines the changing patterns of distortions during the reform process, shows how past policies contributed to these distortions, and estimates the cost to the economy in terms of lower output and greater regional and sectoral disparities. It is shown that after an initial period of increasing fragmentation in product markets, these markets became progressively more integrated as the reform process proceeded. The labor market also become increasingly integrated due to a large shift of the labor force from the agricultural sector to nonfarm sectors and with less control on worker migration. However, inter-sectoral differences in the marginal products of capital widened during the reform process, suggesting increasing segmentation of the capital market.

Local governments seem to have been a driving force behind much of the rent seeking behavior. In the early stages of the reform, distortions begot more distortions as Young has shown. However, in response to an initial increase in product market fragmentation, the central government implemented measures to remove local protection. Consequently, as opportunities to collect rents in product and labor markets diminished, rent-seeking behavior simply shifted to the financial and land markets (including infrastructure and real estate). For local governments, these are the last two bastions for collecting rents, as well as breeding grounds for corruption.

If the reform process is evaluated on the basis of the performance of the product markets, then the observed behavior supports the J-curve theory of economic reforms: initial distortions induced by the reforms soon disappear as the government responds and deepens the reform process. However, when a broader view is taken of all the relevant product and factor markets, the results support Young's argument that as some distortions in a partially reformed economy are removed, new distortions may appear, even if in other markets. The key to successful reform is to deepen the process to squeeze out the distortions in the capital and land market as well as in the product and labor markets.

The continuing large differences in both labor and capital productivity across sectors suggest that China still has great potential for further efficiency gains through continued structural change. To realize this potential, restrictions on factor movement, especially inter-sectoral capital movements, need to be removed. Efficient capital markets that can funnel new investment to sectors with higher returns still need to be developed. The particularly higher capital returns in the rural nonfarm sector suggest that more aggressive government policies should be sought to increase investment there, or at least not to hinder capital movement to those sectors. Such policies would not only improve overall economic performance, but also narrow the development gap and inequality between the rural and urban sectors. Similarly, the government should also encourage labor movement from agriculture to rural enterprises, urban industry, and service sectors as labor productivity in these sectors continues to be much higher than in the agriculture sector.

While the empirical estimates and policy simulations reported here can help to provide rough orders of magnitude about the seriousness of the structural problems identified, policy recommendations for eliminating these distortions need to take into account complex issues, such as their political feasibility, sequencing, implementation problems, the nature of vested interests and ways to overcome them, the need to minimize negative side effects, and their effects on household equity, regional disparities and rural-urban inequality.

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APPENDIX DATA

A. GDP

Both nominal GDP and real GDP growth indices for various sectors from 1978 to 1995 are available from SSB's The Gross Domestic Product of China (SSB, 1997a). The data sources and method of constructing national GDP estimates were published by the State Statistical Bureau (SSB, 1997b). This publication indicates that the SSB has used the U.N. standard SNA (system of national accounts) definitions to estimate GDP for 29 provinces by three economic sectors (primary, secondary, and tertiary) in Mainland China for the period 1952-95. Since 1995, the China Statistical Yearbook has published GDP data every year for each province by the same three sectors. Both nominal and real growth rates are available from these SSB official publications.

We use four sectors in our analysis: agriculture, urban industry, urban services, and rural enterprises. The agriculture sector is equivalent to the primary sector used by SSB. The following procedures were used to construct GDP for the other three sectors. Until 1996, China published annual gross production values for rural industry and services. Since 1996, they began to publish value added figures in China Township and Village Enterprise Statistical Yearbook (SSB). The definition of value added is GDP originating in the sector. The Ministry of Agriculture published data on both gross production value and value added for rural industry (including construction) and services in China's Agricultural Yearbook, 1996. The data on nominal value added for rural industry and services prior to 1995 were estimated using the growth rate of gross production value and 1995 value-added figures, assuming no change in the ratio of value added to gross production value.

GDP for rural industry was subtracted from GDP for industry as a whole (or the secondary sector as classified by SSB) to obtain GDP for urban industry. Similarly, GDP for rural services was subtracted from service sector GDP as a whole (or the tertiary sector as classified by SSB) to obtain GDP for the urban service sector. GDP for rural enterprises is the sum of GDP for rural industry and rural services.

The implicit GDP deflators by province for the three sectors are estimated by dividing nominal GDP by real GDP. These deflators are then used to deflate nominal GDP for rural industry and services to obtain their GDP in real terms.

B. LABOR

Labor input data for the primary, secondary, and tertiary sectors at the provincial level after 1989 can be found in SSB's Statistical Yearbooks (various issues), while provincial labor data prior to 1989 are available in SSB (1990). Labor is measured in stock terms as the number of persons at the end of each year. For rural industry and services, prior to 1984, labor input data at the township and village level but not at the individual household level are available in SSB's Rural Statistical Yearbooks. The omission of individual-household, non-farm employment data will not cause serious problems, as the share of this category in rural employment was minimal prior to 1984. Urban industry labor is estimated by subtracting rural industry labor from total industry labor, and urban service labor is similarly estimated as total service labor net of rural service labor. However, since 1997, the discrepancy between the labor data at the national level by sector and the sum of the data at the province level by sector has shown a large increase. Private conversations with officials in the China Statistical Bureau revealed that the national labor force data are more accurate because they are generated from either census or population sample surveys. The provincial labor force data are reported from lower level governments. When labor becomes more mobile, the difference between the two measures gets larger. In this paper, we adjust labor force data by sector for each province based on the values in 1996 and the annual growth rates of national labor force by sector. The measured trend in capital market integration still holds after this adjustment of the labor force data. However, the variation in the marginal product of labor increases slightly after 1997 when using the unadjusted rather than the adjusted labor force data.

C. CAPITAL STOCK

It is a difficult task to estimate capital stocks by sector and by province. Chow (1993) estimates China's capital stock for five sectors from 1952 to 1988. Because his data series are at the national level, we cannot use them to estimate capital stocks at the provincial level directly. In addition, his five sectors are different from our four sectors.

Li (2003) constructs capital stocks by province from 1984 to 1998 using similar methods to Chow's. The biggest challenge he faced was to construct the initial capital stock values in 1984. He first derived the share of provincial real gross investment and applied it to Chow's national capital to construct the initial provincial capital stock. An implicit assumption made here is that the provincial share of real gross investment equals the provincial capital ratio. However, his capital stock is not sector specific and cannot be used directly in our analysis. So we had to seek alternative approaches.

Capital stocks for the four sectors are calculated from data on gross capital formation and annual fixed asset investment. For the three sectors classified by SSB, the data on gross capital formation by province after 1978 was published by SSB (1997). Gross capital formation is defined as the value of fixed assets and inventory acquired minus the value of fixed assets and inventory disposed. To construct a capital stock series from data on capital formation, we used the following procedure. Define the capital stock in time t as the stock in time t-1 plus investment minus depreciation:

$$K_t = I_t + (1-\delta)\mathrm{K}_{\text{t-1}} \qquad (1)$$

Where K_t is the capital stock in year t, I_t is gross capital formation in year t, and δ is the depreciation rate. China Statistical Yearbook (SSB, 1995) reports the depreciation rate of the fixed assets of state owned enterprises for industry, railway, communications, commerce, and grain for the years 1952 to 1992. We use the rates for grain and commerce for agriculture and services, respectively. Since 1992, SSB has ceased to report official depreciation rates. For the years after 1992, we used the 1992 depreciation rates.

To obtain initial values for the capital stocks, we used a similar procedure to Kohli (1982). That is, we assume that prior to 1978, real investment grew at a steady rate (r) equal to the rate of growth of real GDP from 1952 to 1977. Thus,

$$K_{1978} = \frac{I_{1978}}{(\delta + \mathrm{r})} \qquad (2)$$

This approach ensures that the 1978 values of the capital stocks are independent of the 1978-95 data used in our analysis. Moreover, given the relatively small capital stocks in 1978 and the high levels of investment, the estimates for later years are not sensitive to the 1978 benchmark values of the capital stocks.

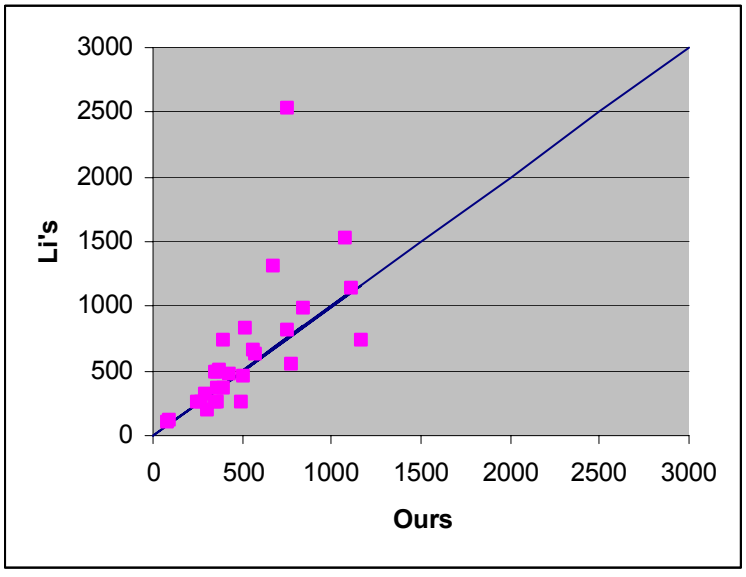
Estimates of capital stocks for rural industry and services are constructed using the annual fixed asset investments by province from 1978 to 1995, which are available in the annual China Statistical Yearbooks and the China Fixed Asset Investment Statistical Materials, 1950-95. Initial values are calculated using equation (4), but the growth rate of real investment prior to 1978 is assumed to be four percent. Again, the initial capital stocks are low, so the estimated series are not sensitive to the benchmark starting values. The capital stocks data from 1996 to 2001 are obtained directly from SSB.

The capital stock for rural industry was subtracted from that of total industry (or secondary industry as classified by SSB) to obtain the capital stock for the urban industry sector. Similarly, the capital stock for rural services was subtracted from the stock for the aggregate services sector (or tertiary sector as classified by SSB) to obtain the capital stock for the urban services sector. Finally, the capital stock for rural enterprises was obtained as the sum of the capital stocks for both rural industry and services.

Prior to constructing capital stocks for each sector, annual data on capital formation and fixed asset investment was deflated by a capital investment deflator. The SSB began to publish provincial price indices for fixed asset investment in 1987. Prior to 1987, we use the national price index of construction materials to proxy the capital investment deflator.

It is worth noting that, when aggregating provincial capital stocks to the national level and comparing the aggregate with Chow's series for the common period of 1978-1988, we find the two series share a very similar trend. We also compare our provincial capital stocks with Li's. As shown in Figure 4, the two data series are closely correlated to each other except in a few provinces. One outlier is Liaoning Province. Li (2003) reports that Liaoning Province has the largest capital stock with a value of 2,918 hundred million Yuan 1984, compared to 1,767 and 1,134 hundred million Yuan in Jiangsu and Guangdong Provinces. However, the official source (SSB, 1997a) shows that the fixed capital formation data for the three provinces are 62.33, 77.96, and 142.52 hundred million Yuan, respectively. Our capital stocks for the three provinces are 744.78, 1077.76, and 843.08 hundred million Yuan, respectively. It seems our series for Liaoning Province is more consistent with the capital formation data. Because Li's paper does not include capital data by sector, we cannot further compare our sectoral capital stocks with his. Despite the difference of the three capital stocks series, they are complementary to each other. When they do overlap, the data series are quite consistent.

Figure 4. Comparison of Two Different Capital Stocks by Province in 1984



Note: The unit is hundred million Yuan.

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